OCR
RECOGNISING ACHIEVEMENT

Advanced Subsidiary GCE

BIOLOGY

Unit F212: Molecules, Biodiversity, Food and Health

Specimen Paper

F212 QP

Candidates answer on the question paper.

Additional Materials:

Time: 1 hour 45 mins

Ruler mm/cm
Scientific calculator

Candidate
Name

Centre
Number

Candidate
Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- 🖉 Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use a scientific calculator.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **100**.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	19	
2	15	
3	13	
4	16	
5	18	
6	9	
7	10	
Total	100	

This document consists of **17** printed pages and **3** blank pages.

Answer **all** the questions.

1 Some species of Acacia tree produce gum Arabic. Gum arabic is classed as a heteropolysaccharide. This means that it is made up of a number of different sugars.

Hydrolysis of gum arabic releases four different monosaccharides.

(a) Describe what happens during the hydrolysis of a polysaccharide molecule.

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.... **[2]**

(b) Complete the table below, comparing gum arabic with some other polysaccharides.

	gum arabic	amylose	cellulose	glycogen
branched structure	yes		no	
heteropolysaccharide	yes		no	
found in animals/plants	plants		plants	
function in organism	healing cuts			energy store

[4]

(c) *Acacia senegal* is a species of tree which is common in the drier parts of Africa. Cattle are allowed to graze on both its leaves and the fallen seed pods. The seed pods have relatively high protein content.

(i) Describe how you would test an extract of the seed pods for protein.

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.... **[2]**

(ii) Describe how you could compare the **reducing sugar** content of the leaves with that of the seed pods.

✎ *In your answer you should make clear how the steps in the process are sequenced.*

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[Turn over

(iii) The **seeds** of *Acacia* species are sometimes eaten by people.

Suggest why it might be better for people living in areas where the tree grows to let their cattle feed on the trees and fallen seed pods and then obtain their nutrition from the cattle.

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.... **[3]**

Total [19]

2 DNA and RNA are nucleic acids.

(a) (i) Describe the structure of a DNA **nucleotide**.

In your answer you should spell the names of the molecules correctly.

You may use the space below to draw a diagram if it will help your description.

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....**[3]**

(ii) Describe how the two nucleotide chains in DNA are bonded together.

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....**[4]**

(b) State **three** ways in which the structure of DNA differs from that of RNA.

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....**[3]**

[Turn over

(c) An antibody is an example of a protein molecule, which has a specific 3-dimensional shape.

Fig. 2.1 shows the structure of an antibody molecule.
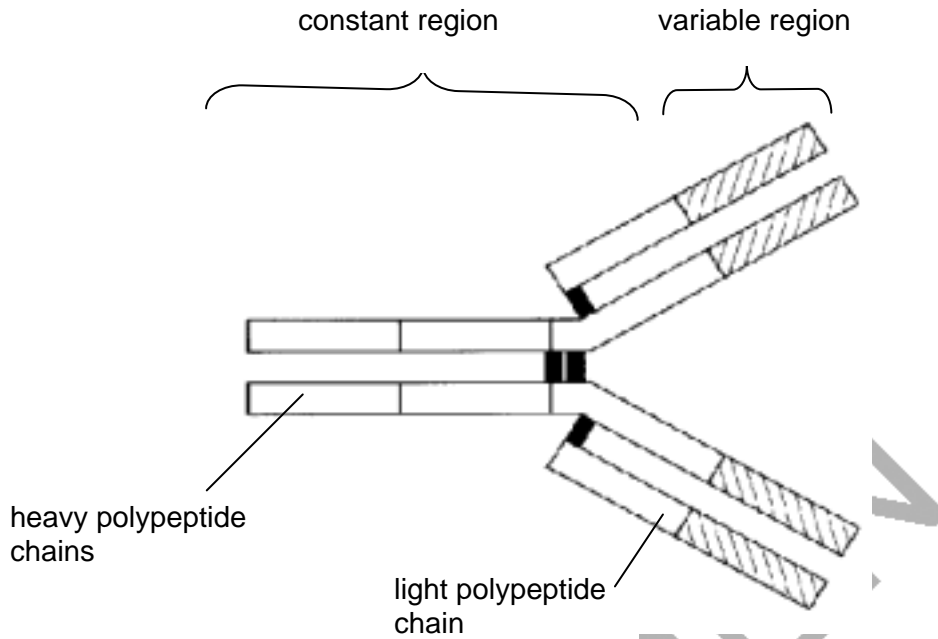
Fig 2.1

(i) Outline how the structure of an antibody molecule is related to its function.

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....**[3]**

(ii) Suggest why the base sequence in the genes for human antibodies is more similar to that found in a chimp than to that found in a mouse.

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....**[2]**

Total: [15]

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3 The fungus, yeast, contains the enzyme catalase.

Catalase speeds up the decomposition of hydrogen peroxide, a toxic metabolic product, to oxygen and water.

$$2 H_2O_2 \rightarrow 2 H_2O + O_2$$
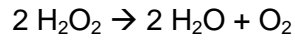
A student decided to investigate the activity of catalase using the apparatus shown in Fig. 3.1.

The total volume of gas collected was recorded every 20 seconds.

The results are shown in Fig. 3.2.

10cm³ of 5% hydrogen peroxide mixed with 5cm³ of yeast suspension
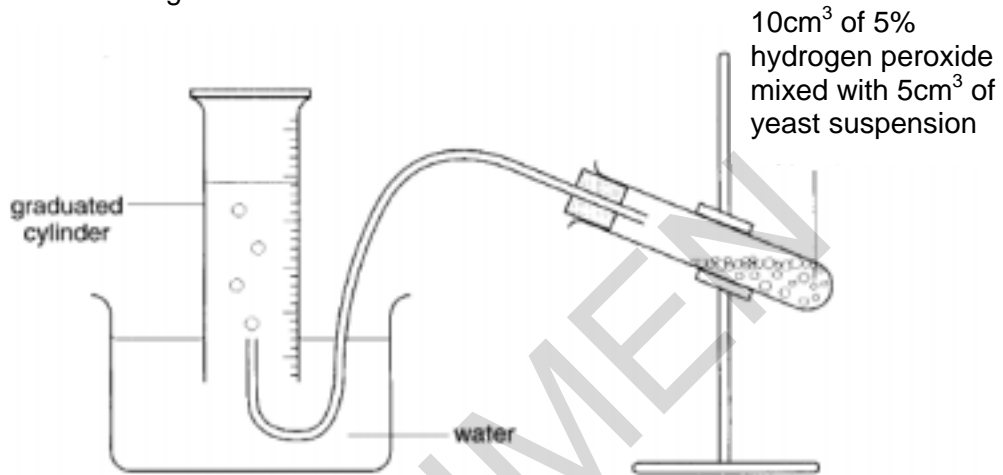
Fig. 3.1
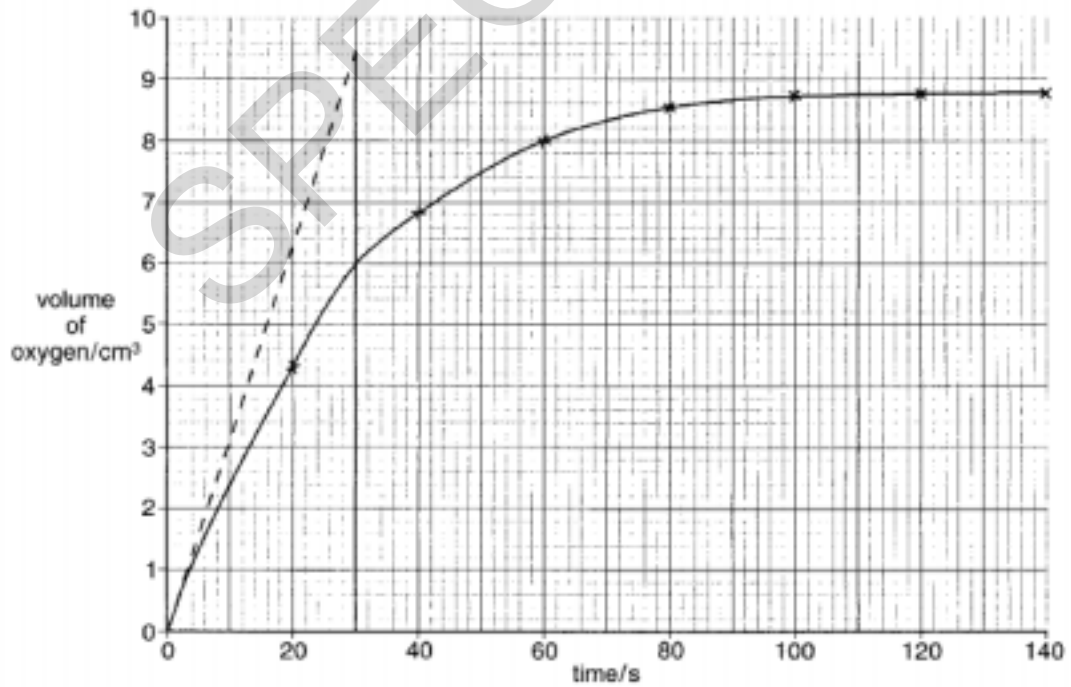
Fig. 3.2

The rate of decomposition can be calculated using the formula:

$$\text{rate of decomposition} = \frac{\text{volume of oxygen collected}}{\text{time taken for collection}}$$

(a) Calculate the rate of decomposition over the first 30 seconds.

Show your working and give your answer in **$cm^3\,min^{-1}$**.

Answer: = ...$cm^3\,min^{-1}$ **[2]**

(b) The initial rate of decomposition is the rate measured within the first few seconds. Using the dashed line in Fig. 3.2, the initial rate of decomposition is calculated to be 19 cm^3min^{-1}.

Explain why the initial rate of reaction is greater than the rate you calculated in **(a)**.

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.... **[3]**

[Turn over

(c) Fungi such as *Fusarium venenatum* are grown in huge batch cultures to manufacture protein for food products.

Explain why these cultures are often maintained at the optimum temperature for protein production and not at a temperature above the optimum.

✎ *In your answer you should make clear how the structure and activity of enzymes relates to the effects described.*

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.... **[8]**

Total: [13]

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4 A group of students carried out some fieldwork to investigate the diversity of insects in three habitats:

- a field of barley

- a field of wheat

- the vegetation under a hedge.

Their results are shown in Table 4.1. Table 4.1 also shows how they used their data to calculate Simpson's Index of Diversity (D) for each habitat.

$$D = 1-(\Sigma(n/N)^2)$$

where N = the total number of insects found, and n is the number of individuals of a particular species.

species	number of individuals of each species in each habitat		
	barley field	wheat field	under hedge
a	32	4	0
b	78	0	1
c	0	126	2
d	0	5	12
e	0	0	8
f	0	0	9
g	0	25	3
h	0	10	3
i	0	0	2
j	0	0	5
k	86	56	0
l	0	0	7
species richness	3	6	10
total number of insects (N)	196	226	52
Simpson's Index of Diversity (D)		0.61	0.86

Table 4.1

(a) State what is meant by the term *species richness*.

....

....**[1]**

(b) (i) Calculate the value for Simpson's Index of Diversity (D) for the barley field.

Show your working and write your answer **in the shaded box in Table 4.1**.

[2]

(ii) Using the data in Table 4.1, suggest why the value of Simpson's Index of Diversity (D) for the vegetation under the hedge is so much higher than that for the wheat field.

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....**[3]**

(c) Describe how the students may have determined the numbers of individuals of each species in each habitat.

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....**[5]**

(d) Studies of biodiversity are an integral part of an environmental impact assessment (EIA).

(i) Discuss the role of an EIA as part of a local planning decision.

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....**[3]**

(ii) Suggest why some conservationists might object to these studies.

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....**[2]**

Total: [16]

[Turn over

5 The leopard, *Panthera pardus*, is a large member of the cat family.

(a) Complete the following table to show the full classification of the leopard.

Kingdom	…………………………………..
……………………………………	Chordata
Class	Mammalia
…………………………………..	Carnivora
Family	Felidae
Genus	………………………………..
……………………………………	*pardus*

[5]

(b) The leopard belongs to a kingdom in which all members are eukaryotic. Plants are also eukaryotic.

Name **two** other kingdoms that contain eukaryotic organisms.

1. ....

2. ....**[2]**

(c) Historically, all organisms were classified into just two kingdoms. In 1988 a five-kingdom

system of classification was accepted. In 1990 a three domain system was proposed.

Discuss, with reference to the **Prokaryotes**, the reasons why classification systems are not universally accepted and why they change over time.

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....**[4]**

(d) *Staphylococcus aureus* is a species of bacterium that is found on the skin.

  (i) Describe how variation may arise within a species of bacterium such as *S. aureus.*

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  .... **[1]**

  (ii) Suggest why such variation alters the characteristics of the individual organism.

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  .... **[2]**

(e) Discuss the difficulties that variations arising in *S. aureus* may cause to the medical profession.

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  .... **[4]**

Total: [18]

[Turn over

6 The Human Immunodeficiency Virus (HIV) is spread by exchange of body fluids between an infected person and an uninfected person. This often occurs as a result of unprotected sexual intercourse.

Fig. 6.1 shows the percentage of people infected with HIV in different parts of the world at the

end of 2002.

Western Europe
0.5 – 1%

Eastern Europe & Central Asia
1 – 5%

North America
0.5 – 1%

East Asia & Pacific
0.5 – 1%

North Africa & Middle East
0.5 – 1%

South & South-East Asia
0.5 - 1%

Caribbean
1 – 5 %

Sub-Saharan Africa
15 – 39%

Latin America
1 – 5%

Australia & New Zealand
0.1%
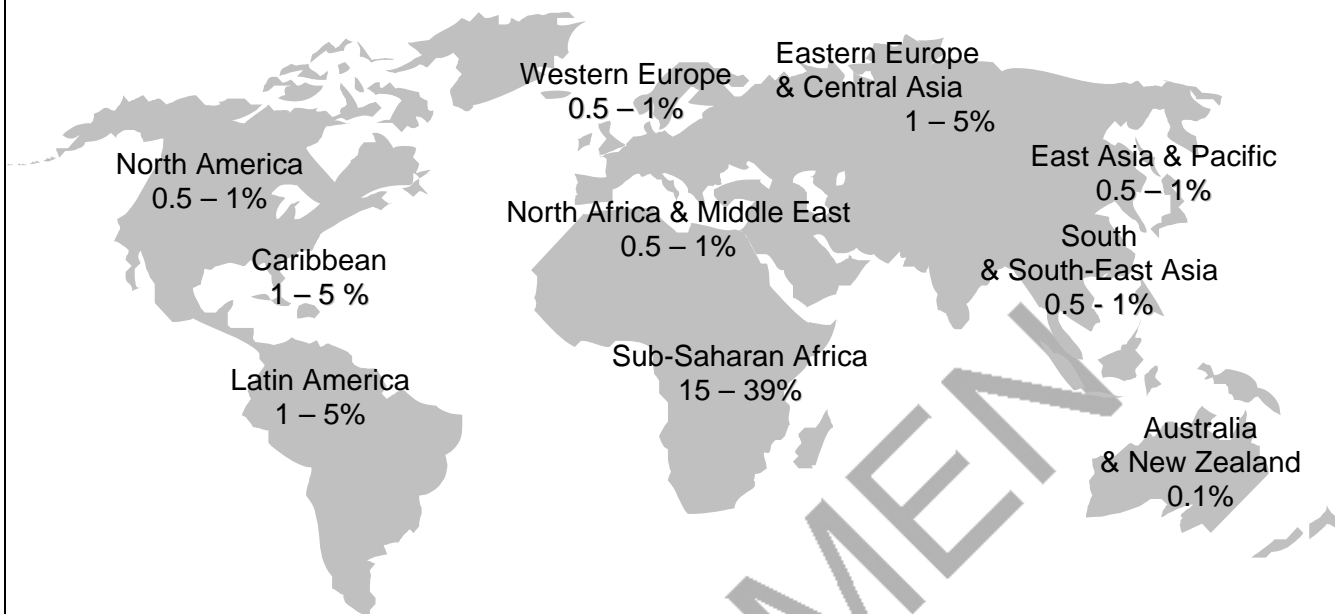
Fig. 6.1

(a) **(i)** The percentage of people infected with HIV is much higher in Sub-Saharan Africa than in much of Europe.

Suggest **three** reasons why the percentages are so much higher in Sub-Saharan Africa.

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.... **[3]**

(ii) Explain why it is useful to collect information, such as that shown in Fig. 6.1.

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....**[4]**

(b) At present there is no cure for HIV / AIDS. Researchers have found that some people in Africa are not infected despite continual exposure to the disease. HIV uses a specific cell surface receptor known as the CD4 receptor to enter a human cell.

Suggest how this information and knowledge of the Human Genome might be used to help reduce the spread of HIV.

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....**[2]**

Total: [9]

[Turn over

7 The black rhinoceros, *Diceros bicornis*, is an endangered species whose numbers have fallen to approximately 3000 in the past thirty years. For this reason, the species was placed on Appendix I of the Convention on International Trade in Endangered Species (CITES) agreement. Since the black rhinoceros has been placed on the appendix, numbers have stabilised, or even increased, in several countries.

(a) (i) Explain the term endangered species.

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.... **[2]**

(ii) Suggest **two** reasons why the black rhinoceros is endangered.

1 ....

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2 ....

.... **[2]**

(b) State two ways in which the CITES agreement is helping to save endangered species, such as the black rhinoceros.

1 ....

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2 ....

.... **[2]**

(c) Outline the potential benefits to agriculture of maintaining the biodiversity of wild animals and plants.

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.... **[4]**

Total: [10]

Paper total [100]

SPECIMEN

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

BIOLOGY   F212 MS

Unit F212: Molecules, Biodiversity, Food and Health

Specimen Mark Scheme

The maximum mark for this paper is **100**.

This document consists of **10** printed pages and **2** blank pages.

SP (SLM) T12103   © OCR 2007 QAN 500/2269/6   OCR is an exempt Charity   **[Turn Over**

Question Number	Answer	Max Mark
1(a)	breaking (glycosidic) bond; **R** if incorrect named bond glycosidic / correct bond drawn; treat 'covalent' = neutral addition of water / H_2O;	**max[2]**

(b) *accept ✓ = yes x = no*
each correct row = I mark

	gum arabic	amylose	cellulose	glycogen
branched structure		no;		yes;
heteropolysaccharide		no;		no;
found in animals/plants		plants;		animals;
function in organism		storage / reserve; **R** 'energy' alone	structural / strength / stops bursting / cell wall / support / gives cell shape; **R** protects rigid = neutral	

[4]

Question Number	Answer	Max Mark
(c)(i)	crush (small amount of) seed pod; add (small volume of) biuret, A / NaOH, <u>and</u> biuret, B / CuSO$_4$; positive = colour change from blue to, mauve/purple;	max[2]
(c)(ii)	*preparation - allow 2 marks max:* 1 crush, samples / leaves and seed pods, separately with water; 2 use same mass of each / AW and use same volume of water; 3 filter; *method - allow 4 marks max:* 4 add benedict's reagent to filtrate; **A** CuSO$_4$ in alkaline solution 5 <u>excess</u> reagent used / stated volume; 6 same volume added; 7 heat in a water bath/ at near boiling; 8 for stated time (up to 5 min); *analysis - allow 2 marks max:* <u>either</u> 9 colour change from blue to green / yellow / orange / red; 10 shows increasing concentration of reducing sugar; <u>or</u> 11 use of centrifuge to remove precipitate; 12 use of colorimeter to compare intensity of blue colour in liquid portion; 13 red filter used in colorimeter;	[8]
(d)	humans eat only the seeds so do not gain, nutrition / energy, from, leaves / pods; seeds maybe deficient in (some) essential amino acids; cattle better at digesting, plant matter / seeds / leaves / pods, than humans / AW; meat (from cattle) provides more essential amino acids for humans (than plant material)/AW; cattle also produce milk; AVP; e.g. cattle naturally roam to find food / intensive labour needed for human collection of plant material;	max [3]
		Total: [19]

Question Number	Answer	Max Mark
2(a)(i)	<u>deoxyribose</u> sugar; a nitrogenous/ nitrogen containing, base / named base; ecf for thiamine phosphate group; AVP; e.g. deoxyribose is a pentose sugar/correct diagram of same *accept A, T, G and C in place of names.*	**max[3]**

(a)(ii)	hydrogen bonds between bases;
	<u>complementary</u> base pairing;
	purine to pyrimidine;
	A to T <u>and</u> G to C;
	
	AVP; further detail e.g. 2 H bonds between A and T / 3 H bonds between
	        C and G
	        DNA polymerase
		max[4]

(b)	ribose (instead of deoxyribose); uracil /U, replaces thymine; single stranded (instead of double stranded); smaller molecule/ different 3-D structure to DNA;	**[3]**

(c)(i)	*any three from the following:*
	award mark only if structure related to suitable function
	
	variable region is antigen binding site; **R** receptors / 'sticky ends' / active
	        site
	(shape of) variable region specific to antigen / amino acid sequence (of
	        variable region) gives, complementary / matching, shape;
	
	hinge region allows flexibility in binding / AW;
	
	constant region, for binding to receptors on cells / phagocytes / mast cells;
	
	AVP; e.g. disulphide bonds hold polypeptide chains together
		[3]

(c) (ii)	human and chimp are more closely related; common ancestor is more recent; less time for, mutations / variation, to arise;	**[2]**
		Total: [15]

Question Number	Answer	Max Mark
3(a)	*award two marks if correct answer (12) is given* 6/30 / 6/0.5 x 60; 12;	**[2]**
(b)	*assume candidates are referring to the initial rate unless otherwise stated.* concentration of, substrate / H_2O_2, molecules, high / higher at start; more chance of, substrate/ H_2O_2, molecules entering active site; all / most, active sites occupied;	**[3]**

(c)	*at optimum temp - max 3 marks*
	molecules in culture have kinetic energy;
	(frequent) collisions between enzyme and substrate molecules;
	more enzyme-substrate complexes formed;
	max rate of reaction / protein production achieved;
	
	at higher temp - max 5 marks
	(at higher temperature) molecules have <u>more</u> kinetic energy /
	      collisions occur more frequently and with more energy;
	molecules vibrate and, bonds/ hydrogen bonds, broken;
	tertiary structure / 3D shape, of enzymes altered;
	active site loses, precise / complementary, shape;
	enzymes are <u>denatured</u>;
	substate molecule no longer fits active site;
	(may be) irreversible so reaction/ protein production stops; **A** fungus
	      destroyed
		[8]

		Total: [13]

6

Question Number	Answer	Max Mark
4(a)	number of different species present/AW;	[1]
(b)(i)	0.62;; *award one mark if working correct but answer wrong*	[2]
(ii)	*award marks only if comparative points given* hedge vegetation has greater species richness than wheat; numbers of insects under hedge more evenly spread compared with numbers in wheat field / AW; more niches for insects in vegetation under hedge/ more species of plants grow under hedge than in wheat field/ AW; ref. use of, chemicals/ insecticides/herbicides, on wheat and not on hedge vegetation; AVP; e.g. ref. plants under hedge more likely to be wild/native compared with wheat crop / AW	max[3]
(c)	*Any four from the following:* ref. random samples; sweep net; repeats in each habitat; ref need for same technique in each habitat; classify and count numbers of each species(of insect) caught; AVP; e.g. further detail of sampling such as use of suitable chemical to stun the insects;	max[5]
(d) (i)	ref to (bio)diversity values and need for conservation; ref to endangered species and need for protection; ref to laws concerning endangered species (that might affect decision); ref to planning stipulation e.g. translocation of species; AVP; e.g. example of type of local planning decision;	max[3]
(d) (ii)	damage to environment / ecosystem; disturbance to animals in area; habitats best left alone / left to nature/AW; AVP; e.g. may advertise presence of endangered species to collectors	max[2]
		Total: [16]

Question Number	Answer	Max Mark
5(a)	Animalia / animal(s); Phylum; **A** phylum Order; **A** order *Panthera*; species;	**[5]**
(b)	Fungi; **A** fungi Protoctista; **A** protoctists / protista / protists	**[2]**
(c)	scientific knowledge changes as new discoveries are made / AW; technological developments lead to new discoveries; named technological development; e.g. microscopes, new DNA technology ref. (legitimate) differences of opinion amongst biologists/scientists /taxonomists; ref. true bacteria (bacteria) and archaea; ref. differences between bacteria and archaea; e.g. different RNA polymerase, membrane structure, flagellae, histones AVP; e.g. other relevant detail of prokaryotes	**max[4]**
(d)(i)	change in DNA/ genetic material, through spontaneous mutation;	**[1]**
(d)(ii)	DNA/ genetic material, determines protein structure/controls protein synthesis; (mutation) changes protein structure/ enzyme structure/ antigen structure;	**[2]**
(e)	*any four from following:* development of new strains (of bacterium)/ bacteria multiply rapidly; development of resistance to antibiotics; need to find more antibiotics; need wide range of antibiotics for one species of bacterium; vaccines no longer effective; AVP; e.g. antibodies may not recognise changed antigens / no longer effective / ref. MRSA	**[4]**
		Total: [18]

Question Number	Answer	Max Mark

6(a)(i)	*any three from following:*
	
	education on HIV / AIDS less effective **;**
	sexual attitudes / number of partners **;**
	availability of condoms **;**
	poverty / poorer / less money **;**
	sex industry **;**
	less primary health care / less likely to be diagnosed **;**
	
	AVP **;** e.g. ref to unscreened or untreated blood
	    unsterilised needles or surgical apparatus
	    civil war / rape
	    no alternative to breast feeding
	
	R access to drugs for treatment
	R no vaccine
	R ref to intravenous drug addiction
		[3]

(ii)	*any three from the following:* to find out where rates, are highest / people are most at risk **;** to keep track of infection rates over time/ AW **;** to see where disease is likely to spread / where epidemic most likely **;** to help research (into how it is spread / into effectiveness of drugs) **;** to allow organisations to provide, aid / health care, where it is needed most **;** to allow organisations to provide education (about disease) where it is needed most **;** AVP **;** e.g. tourist industry	**[3]**
(b)	find person who is immune and isolate gene that provides immunity **;** use gene to find shape of protein that provides immunity and manufacture protein to use as vaccination / cure **;** find shape of CD4 receptor **;** develop drug to block receptor **;**	**2 max**
		Total: [9]

Question Number	Answer	Max Mark
7(a)(i)	species numbers have become low / habitat reduced, qualified; population has reached a critical level / AW; there is a risk of extinction;	**max [2]**
(ii)	*any two from the following:* shot to prevent damage to farmland; **A** other appropriate reason habitat destruction; hunting; poaching; killed for horn; **A** ivory killed, for meat / hides;	**[2]**
(b)	*any two from the following:* signatory countries made it illegal to, kill / poach, rhinos; ban placed on trade (in horns); increased cooperation between countries; permits / licenses, issued; education / raising awareness;	**[2]**
(c)	source of food; source of plant varieties for cross breeding / selection; to breed in disease resistance / pest resistance; to breed in other named characteristic; e.g. higher protein content / quicker growth source of natural predators to pests; AVP;	**max [4]**
	Total:	**[10]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)	2			**2**
1(b)	3	1		**4**
1(c)(i)			2	**2**
1(c)(ii)	3	2	3	**8**
1(c)(iii)		3		**3**
2(a)(i)	3			**3**
2(a)(ii)	4			**4**
2(b)	3			**3**
2(c)(i)	3			**3**
2(c)(ii)		2		**2**
3(a)		2		**2**
3(b)		3		**3**
3(c)	3	5		**8**
4(a)	1			**1**
4(b)(i)		2		**2**
4(b)(ii)		3		**3**
4(c)			5	**5**
4(d)(i)	1	2		**3**
4(d)(ii)		2		**2**
5(a)		5		**5**
5(b)	2			**2**
5(c)	2	2		**4**
5(d)(i)	1			**1**
5(d)(ii)	2			**2**
5(e)		4		**4**
6(a)(i)	1	2		**3**
6(a)(ii)		4		**4**
6(b)		2		**2**
7(a)(i)	2			**2**
7(a)(ii)	2			**2**
7(b)	2			**2**
7(c)	2	2		**4**
Totals	**42**	**48**	**10**	**100**
Targets	**42**	**48**	**10**	**100**

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